THE EFFECTS OF RUNNING SHOES ON GROUND REACTION FORCE IN MALE RECREATIONAL RUNNERS

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Introduction

Running is an accessible type of cardiovascular exercise, among its numerous benefits. However, running-related injuries are prevalent among runners, with up to 79% of runners suffering from musculoskeletal ailments annually. The high incidence of running-related injuries has prompted healthcare professionals and researchers to investigate their causes and prevention strategies. Barefoot performance is an unstable condition, and barefoot running has recently gained popularity among runners who believe it may result in fewer running-related injuries. Bionic shoes combine the functions of barefoot running and foot protection and incorporate traditional unstable structures based on bionic science. The purpose of this study was to investigate ow bionic shoes affect ground reaction force (GRF) before and after a 5 km run.

Methods

Sixteen male recreational runners participated in this study and finished two 5 km running sessions (a neutral shoe session and a bionic shoe session). Two-way repeated-measures ANOVAs were used to analysis the differences in GRFs.

Results

The results showed that compared to the neutral shoes, bionic shoes have significant decreases in vertical impulse, peak propulsive force, propulsive impulse, and contact time, while the braking impulse and vertical instantaneous loading rate (VILR) increased significantly. Main effects for a 5 km run were observed at vertical GRFs and anterior-posterior GRFs. Post-5 km running trials revealed an increase in peak vertical impact force, vertical average loading rate (VALR), vertical impact loading rate (VILR), peak braking force, and peak braking impulse, and a decrease in peak propulsive force and peak propulsive impulse. The interaction effects existed in VILR and contact time.

Discussion

The results suggest that bionic shoes may benefit runners with decreased injury risk during running. Based on the results of this study, bionic shoes and a 5 km run altered ground reaction forces during running, especially the vertical and anterior–posterior forces. These findings provide preliminary evidence suggesting that bionic shoes combined with the functions of barefoot running and protective elements, traditional unstable structures and bionic science may benefit runners in reducing injury risk during running.

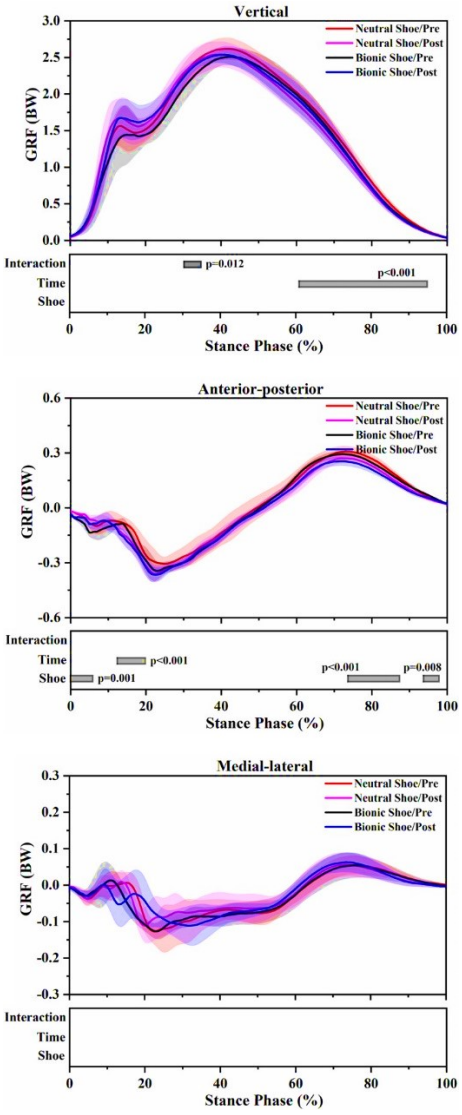

Figure 1: Ground reaction forces (GRFs) waveforms of the mean (SD) over the stance period of four running tests. Significant main effects of the shoe conditions, 5 km run, and interaction effects ($p < 0.05$) are highlighted (grey horizontal bars at the bottom of the figure) during consistent periods from SPM1d analyses.

References

1. Gu et al, Hum. Mov. Sci, 36: 46-57, 2014.
2. Jiang et al, Healthcare, 9: 236, 2021.
3. Xu et al, Front. Bioeng. Biotechnol, 9:711, 2021.